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VACATION OBSERVATIONS—II

By Francis E Lloyd

Propulsion of Gemmae in Lycopodium lucidulum.—Leavitt * reports that the gemmae of *L. lucidulum* may be thrown to a distance of 3 to 4 feet. He induced the propulsion by pressing down gently at the extreme edge of the cotyledon-like leaf of the gemma. It is further suggested that in nature the gemmae must be struck by some object such as a moving plant or animal, or a rain drop, in order that the tension set up by the tissues of the clasping organ may be utilized for the expulsion of the gemma.

Having found a patch of gemmiparous plants at Northfield, Mass., early in September, I was led to repeat the experiments of Leavitt, at first by the method which he used, as above described, a method which I had used earlier in the case of *L. Selago* in the Austrian Tyrol.† It soon occurred to me, however, that there was a better way of doing it, possibly imitating the condition in nature more closely, namely by pinching the gemmiparous branch at its base in such a manner as to exert a slight pressure upon the leaves which clasp the gemma. It became possible in this way to set free the gemma without interfering in any way with its flight. By holding the plant near the ground on a level spot, so as not to give it any advantage of elevation, I found that the maximum flight reached somewhat over three feet, though in the majority of cases the range fell within fifteen inches. The trajectory, moreover, is markedly curved, falling in

* Leavitt, R. G. Notes on *Lycopodium*. Rhodora, 4 : 57–60. Mr. 1902.

†Lloyd, F. E. Observations on *Lycopodium*. Torreya, 2 : 20, 21. F. 190 .

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the most striking instances from four to six inches in three feet. According to Leavitt, the longest horizontal distance of flight measured by him was 25 inches, though he adds : " The range of the trajectory *may* be three or four feet, *at the greatest.*" (Italics mine.)

Now, assuming that the normal range of flight for these gemmae is three feet, and that they fall only four inches in that distance, which gives us very favorable data for an estimate, the gemmae shot out from the 'up side' of a plant growing on a slope with one foot rise in three, would reach a distance of only about sixteen inches, measured on the slope, even if we assume a horizontal flight. If the plant be tilted so that its axis is at right angles to the slope, the force which would carry the gemma to a distance of three feet, with a vertical rise of one foot, would carry the object approximately six feet, horizontal distance, a conclusion quite at variance with the observed facts.

It would seem strange, too, that the gemmae which Leavitt saw were to be found only in *one* direction from the nearest adult plants as it is well enough known that they grow out in various positions on the stems.* An examination of these plants would have shown the basal parts of the gemmiparous branches, and Leavitt's conclusion may thus have been tested. To be sure, there is also the possibility that the conditions in other directions were not favorable for germination ; but in the absence of definite evidence to the contrary we must assume that they were. There is, therefore, a considerable degree of probability that the plantlets referred to had some other origin.

Finally, the supposition that in order to initiate the propulsion of the gemma it must be struck by some moving object, may be beyond the facts. We may as justifiably assume that the mechanism is complete in itself, and that the tensions set up in the clasping leaves are sufficient to cause the phenomenon. Our observations touching this point are incomplete, and it is therefore better to hold the judgment in abeyance.

Movements of Leaflets in Onoclea sensibilis. — The statement

* Goebel has pointed out in the Organography (p. 651) that the gemmae do not grow on the side of the stem turned toward the sister stem of a fork but this, of course, does not affect our statement.

made by Amos Eaton in his botany published in 1824, that the leaflets of *Onoclea* "slowly approach each other on squeezing the stem with the hand," * prompted me to determine, if possible, what basis of fact there might lie beneath it.

Accordingly an attempt was made, in rather crude fashion, to be sure, to determine whether there was any movement rapid enough for ready observation. I was encouraged to do this by the experience which I had in noticing that the lowermost leaflets did approach each other sensibly within a period of ten minutes after plucking.

A series of experiments was carried out by cutting off the petioles of the leaves desired close to the ground, and pouring on water to prevent the entrance of air into the tissues in the event of negative pressure. Some were then measured by taking the distance between the tips of the bottom pair of leaflets, and between the tip of one of these and the apex of the leaf. The latter measurement proved of no value, since the twisting of the whole leaf vitiated the results. After measurement a few were allowed to stand in water, and others allowed to dry, and in the latter the movement of the leaflets was usually to be noted in five minutes although in some cases negative results only were obtained. Those remaining in water, on the other hand, usually remained fresh and showed no movement. The measurements of a few cases of leaves allowed to remain out of the water are given.

Time	9.55	10	10.02	10.15	10.55
Distance between tips of leaflets in inches.	2 5/8 3 3/4	2 1/8 3 1/2	2 3 1/2	1 5/8 3 3/8	7/8 2 1/2
Time.	10.40	10.45	10.50	11.30	
Distance between tips of leaflets in inches.	2 3/4 3 1/8 3 1/2	2 5/8 2 7/8 3 1/4	2 1/2 2 3/4 3 1/8	1 1/2 1 3/4 —	

* My attention was drawn to this statement of Eaton's by a paragraph, written by Miss B. L. Putnam in the Fern Bulletin, 7 : 15. Ja. 1899.

It appears from the experience of the writer, that the lower leaflets show a good deal of movement and that such movement is due to the rapid wilting of the leaf. There is a curious feature of the phenomenon, however, in the fact that the lessening of the distance between the leaflet tips is not due to a general curvature in those parts, at least in the early part of the process, but rather to a more local, and therefore stronger, curvature at the base of each leaflet.

The matter would seem not unworthy of further examination. We still are unable to answer the curious in regard to the origin of the specific name; nevertheless, that the leaf is "sensitive" appears doubtless true. "Squeezing the stem" has, however, nothing to do with it.

Spore Expulsion in Webera (Diphyscium) sessilis. — The peculiar, dorsiventral form assumed by the sporogonium of this plant is, according to Goebel, assumed under the influence of one-sided illumination. This was shown by cultivating the young sporogonia, which are radially symmetrical under appropriate conditions. The same author explains the form of this organ teleologically as an arrangement by which the dissemination is facilitated by falling raindrops.*

By tapping the upper side of a dry ripe capsule with a pencil point the action of the raindrop falling upon it may be imitated. In this way I have been able to see a puff of spores shot out very rapidly to a distance of two inches. Doubtless the natural conditions result still more favorably. The behavior is sufficiently striking, however, as it stands.

A KEY TO THE NORTH AMERICAN SPECIES OF CORTINARIUS.—II†

By F. S. Earle

Inoloma

1. Lamellae at first white or pallid. 2.
   Lamellae at first violaceous (as also the stipe and cortina). 4.
   Lamellae at first yellow, red, or cinnamon. 11.

* Organography (translation), p. 237.

† Continued from page 172.